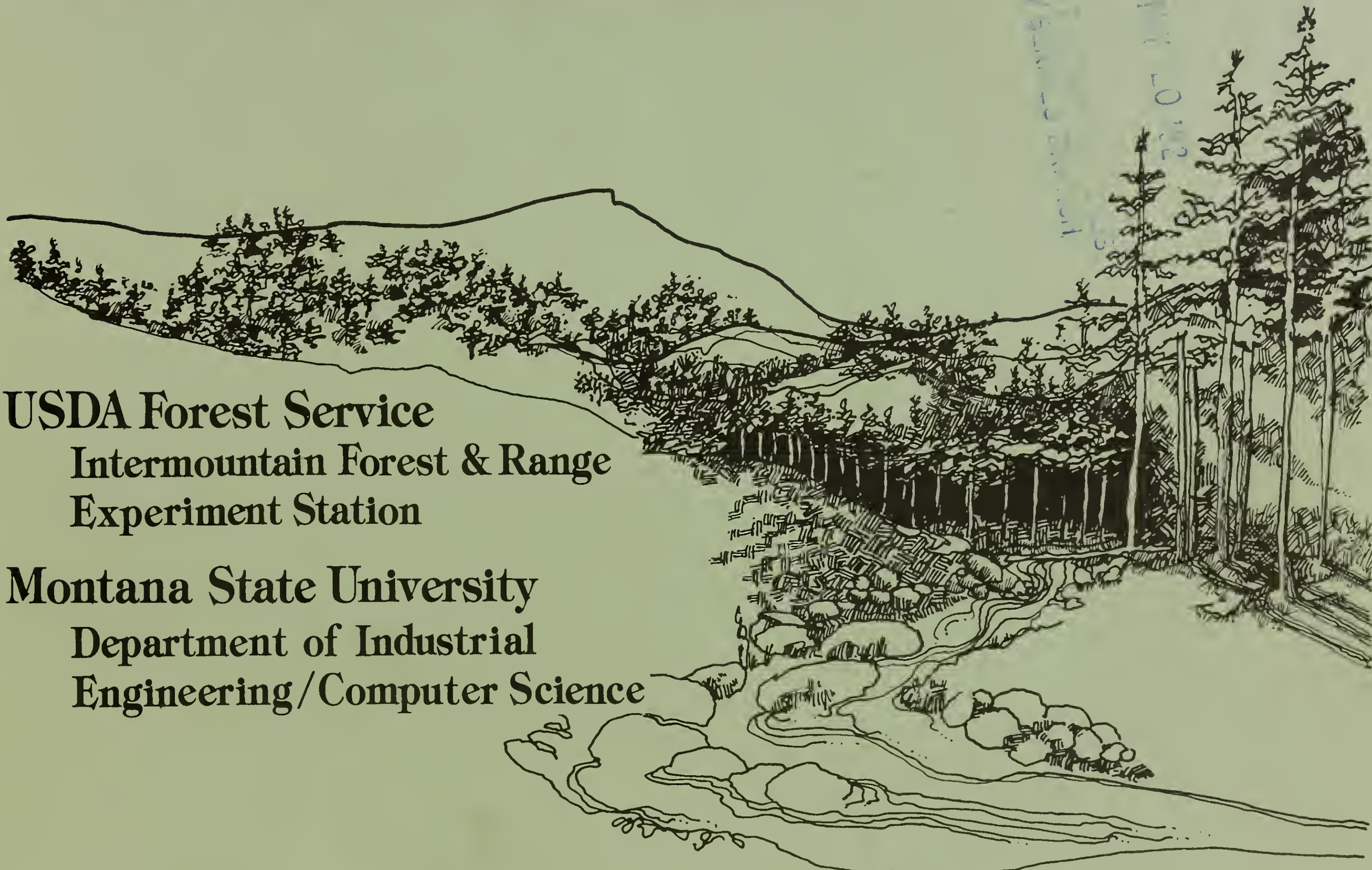
AMPLAN
LAIM
USER'S DATABOOK



USDA Forest Service
Intermountain Forest & Range Experiment Station

Montana State University
Department of Industrial Engineering/Computer Science

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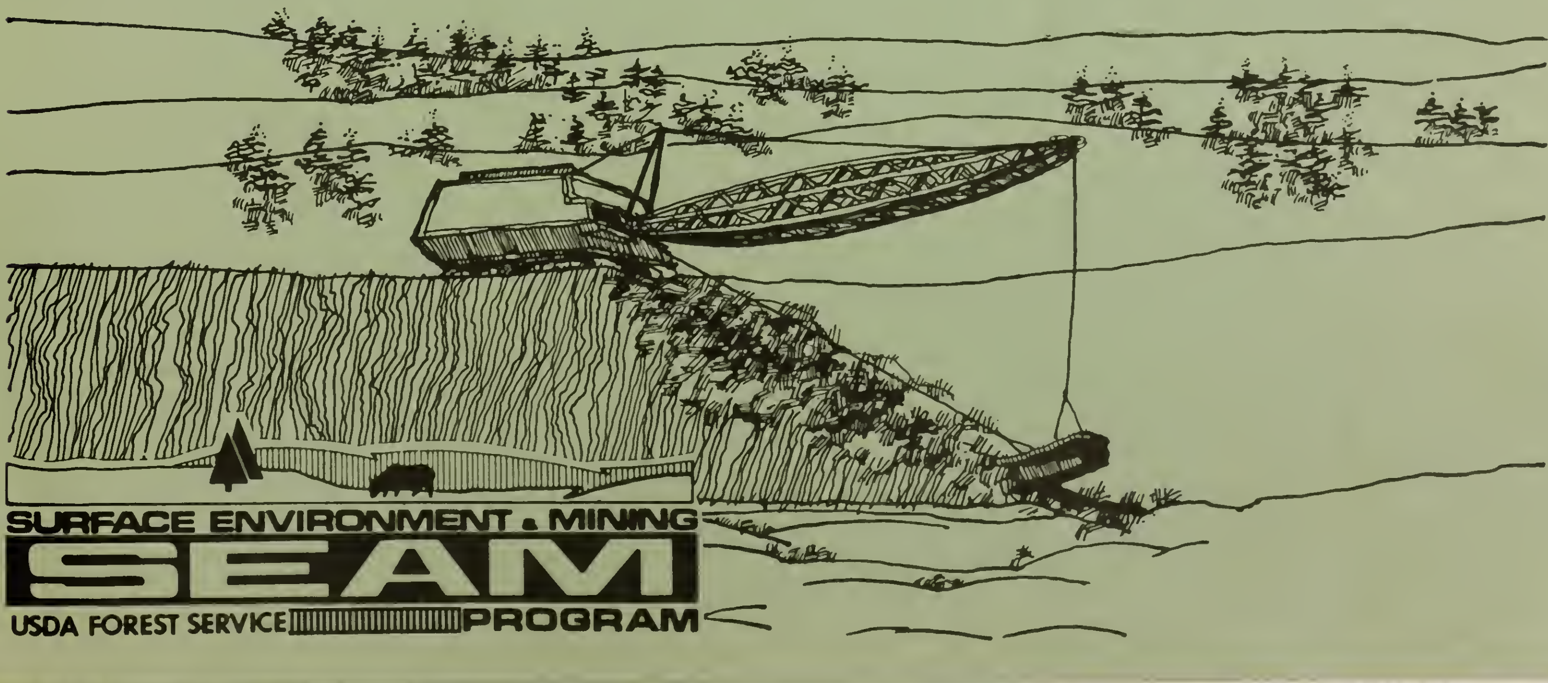

SURFACE ENVIRONMENT & MINING
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Vol. IV

SEAMPLAN

CLAIM

Computerized Reclamation Planning System for
Northern Great Plains Surface Coal Mines

User's Databook

January, 1980

Prepared by

M. Douglas Scott
Office of Research and Development
Montana State University, Bozeman, MT 59717

for

USDA Forest Service
Intermountain Forest and Range Experiment Station
Surface Environment and Mining (SEAM) Program

Montana State University, Cooperating

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INTRODUCTION

The following databook pages request operational and environmental data which the reclamation manager has collected for his specific mine site. These data then can be analyzed by the CLAIM computer system to determine the relative environmental feasibility of returning the mined land to several land use options, and to determine the costs and techniques involved in creating each type of land use. This system presently can be used only for the Northern Great Plains area of eastern Montana, western North Dakota, northwestern South Dakota, and northeastern Wyoming. The kinds of data, and the range of values within each kind, were determined from many literature sources and interviews to be needed for reclamation planning in the Northern Great Plains. The User's Manual contains a literature review in the sections on FEASI and TECON calculations, which describes the sources for many of the data categories, as well as how the data are manipulated by the CLAIM system.

DATA REQUIREMENTS

In completing the databook, the user should simply check the appropriate category, or enter the actual data value, whichever is called for, under each subheading. Before starting to enter data, however, it should be noted that most of the data requested represent averages for the entire area to be reclaimed (such as the average A horizon topsoil thickness for a whole 40 acre block of land). Also, for these averages to be meaningful, the block of land to be examined should be fairly homogeneous with respect to topography, elevation, and soil types. Thus, if a significant lowland marsh occurs in the center of a large upland site, a separate reclamation plan should be developed for

the marshy area - even if it is planned to have the same final land use for both areas. (This is because the methods and feasibility of returning the two areas to the same land use may be quite different.)

The data required by the system are in some cases fairly detailed, and some may not be immediately available to the user because of time or monetary constraints. In this case, the user's best estimate of the datum may be inserted, but it should be remembered, the results are only as good as the original data used. In many cases, the user will want to consult with specialists in obtaining the answers to data items. If the user operates CLAIM in conjunction with the SEAMPLAN mine planning system, the mine description data (category I) will be automatically entered into CLAIM for dragline type mines only. This process is described more fully in the CLAIM users manual, and in the SEAMPLAN documentation.

SPECIAL NOTES ON DATA INPUTS

Most of the data requirements on the following pages are self-explanatory. However, for those items where it was thought there might be a question as to what is required, a few clarifying remarks are presented here.

I,C. The average slope of 10 random points can be found by randomly marking 10 spots on a topographic map of the area of interest. The slopes of lines perpendicular to the contours, and passing through the points, are then calculated for each point. This is done by measuring the horizontal distance along a line which covers four contour intervals, then dividing this value into the vertical distance covered by the four contours. This value (a slope percent) is converted to degrees from a standard table available for this purpose.

I,D 4; E4. These average slopes can be calculated by the same method as for IC above.

I,F 4. This vertical height of the spoil bank is measured from the bottom of the pit.

I,G 6,7. These values are the most important inputs in this section, because they will determine (with the computer's aid) how the benches must be laid out. Items 2 and 4 may be relatively fixed because of machine characteristics or spoil cohesiveness. Item 3 should be set up as the operator's best estimate as to what widths are needed to achieve the final slopes desired.

I,H 2,3; I 2,3. These rehandle volumes may be needed to bring the base elevation of the pit up to a height so that when next year's spoil is placed in the pit, the final graded contours will be high enough to meet the final land use restrictions--such as for a stream channel.

III,D,E. These values should be calculated after test soil has been removed, stored, and respread on the final surface.

IV,C,D. These values should be calculated after test subsoil has been removed and respread over the final graded spoils.

V,A. This value should be calculated for an area that has recently been mined which has overburden units similar to the area under consideration. Several 10 x 10 foot plots should be randomly set up on the mined area, and the average number of 12 inch rocks should be determined. This value should then be converted to a per acre value.

V,B. If a lithologic unit is less than 5 feet thick, it should be combined with the unit immediately above it. When the units are core sampled for overburden tests, they should be thoroughly mixed, and

a sample taken from the composite for analysis. If several bands less than 5 feet thick are found together, they should all be combined as one unit, and one sample of the mixture should be taken for analysis.

V,C. This value should be calculated from a nearby mined area that has similar overburden units and has spoils that have weathered one year.

V,D. This value should, likewise, be calculated for a nearby mined area.

VI,A. If both a permanent pond and a perennial stream are on the property, the permanent pond is the most reliable source of water.

VI,B. This value must be obtained from at least a one-year baseline study of the amount of surface water flowing across the property. Legal rights to the water must also be determined.

VI,C. This value is easily obtained from an aerial photo of the property to be reclaimed. On such a photo, the planner should measure the total length of temporary stream channels (gulleys) for the whole area, and convert this to feet--based on the scale of the photo. He then should determine the total acreage in the area,and divide this into the total number of feet of channels, to get the correct value.

VI,D. This value is also obtained from an aerial photo of the reclamation site. The planner should measure (in feet) the total length of all stream channels on the property that flow at least one month per year. He then should calculate the total acreage for the area, and divide that number into the total number of feet; to get the correct value.

VII,B. This value should be determined from extensive groundwater pumping tests conducted over a year's time. Also, legal availability should be determined for the right to appropriation.

VII,E. The alluvial valley floor is defined according to the 1977 Federal surface mining law.

VIII,A,5. If a threatened or endangered plant species (as listed in the Federal Redbook) is present, it and its plant associates constitute the most important plant community present. Any of the other four types are the most important if they cover more than 50 percent of the surface area. If the site has no community covering more than 50 percent of the area, it should be broken down into smaller units until one community does cover a majority of the area.

VIII,B. A secondarily important plant community is one that covers less than 50 percent of the surface area on the homogeneous reclamation unit.

IX,A. The most important wildlife type is that one which, in the planner's estimation, provides the most recreational value to the citizens of that county or region. If a threatened or endangered animal (listed in the USFWS Redbook) is present, it must be classified as the most important, regardless of its recreational value.

IX,B. Secondary wildlife types are those that provide limited recreational values to humans, on that particular reclamation area.

X,B, 1. Prime agricultural land must meet several legal requirements, as listed in the 1977 Federal surface mining law. Often, cropland is present which does not qualify as "prime" agricultural land. A primary land use must cover greater than 50 percent of the land area. If this does not occur, the reclamation block size should be reduced.

X,C. Secondary land uses cover less than 50 percent of the sites' surface area. Prime agricultural land cannot be a secondary use.

X,D,E,F. The land use desires of surface owners, communities, and government agencies should be obtained through personal interviews with these entities.

LEVELS OF USE

One way to optimize the use of the CLAIM system is to apply it at different stages of the mine's development. During early exploration or planning stages, broad estimates for the various required data can be obtained for the whole area (possibly in the 1000's of acres), and an overall rough reclamation plan, with costs, can be developed. Later, as more detailed environmental data become available, and as the mine plan is firmed up, more specific reclamation plans can be developed for smaller parcels of land - possibly corresponding to the 1 year, or 1 quarter mine plan. Once the mine is in operation, new sales of coal, or other factors, may necessitate sudden changes in the mining and reclamation plans. With the area's data base already established, the reclamation options associated with the new mine plan can be quickly evaluated by the reclamation manager.

EXPECTATIONS OF SUCCESS VALUES

The 5 numbers to the right of each datum category on the following pages are "expectations of success" values, which represent the probability, or relative expectation of success, of returning a parcel of land having that particular environmental condition back to a certain land use. In assigning these values, each environmental category is considered entirely independently of any other category.

The expectation of success values range from 0 to 4. Zero means no expectation of success, such as trying to establish grain crops on

an area with an average slope of 19^{o}. A 1 ranking means a negative expectation of success - such as establishing cropland in soils having a salinity (EC) value of 8.1-16.0 mmhos/cm. A 2 ranking implies a neutral expectation of success, such as growing crops with average annual precipitation of 15.1-20 inches per year. A 3 value means a positive expectation of success - such as growing crops on flat (versus hilly) land. The value of 4 means a particular land use goal <u>must</u> be achieved if that environmental category is checked, and this is usually determined by law. Thus, if "prime agricultural land" originally existed, the land must be primarily reclaimed to the cropland land use option. However, under such a condition, some of the other land uses may be possible as secondary, complementary land uses.

The ranking values printed on these pages are "default" values, which will automatically be used in all computer processes unless they are changed. These values are based on the review of much literature and practical experience, but they are not infallible. If the user would rather insert his own expectation of success values for any, or all, of the datum categories, he may do so in the edit mode of CLAIM (see the user's manual for details). The changes made in the expectations of success values will be totally incorporated into the FEASI (environmental feasibility) subsystem, but, due to its complexity, cannot be incorporated into the TECON (techniques and economy) subsystem.

THE "OTHER" LAND USE CATEGORIES

The user also will note that a sixth land use category - "other" is left open. If the reclamation manager has a specific land use in mind, such as a golf course or a housing project, he may enter his own

expectation of success values for all the databook categories. Then, when he enters the actual site-specific data, the computer will rank the environmental feasibility of returning the area to that land use option in relation to the other five general land use options. Due to the variability of what might be entered in the "other" land use, the TECON subsystem cannot compute the costs and techniques for achieving the new option, however.

USER'S AND PROGRAMMER'S MANUALS

Finally, before actually operating the CLAIM system on a computer terminal, the reader should quickly review the user's manual for details on operating the program. If the user is a capable programmer, or has access to such a person, he may even wish to change the program to meet his specific needs. In this event, the documentation in the programmer's manual, and the program listing itself, are available as a starting point. An altered program, however, can only be operated on the user's own computer hardware system.

CLAIM DATA INPUT

Mine Description Data

I. General description of proposed homogeneous mining and reclamation planning unit.

	Cropl.	Native Veg.	Wildl.	Water Recr.	High Use Struct.	Other
			Expectation of Success for each land use			
A. Type of Mine						
____ 1. Dragline	2	2	2	2	2	____
____ 2. Truck and Shovel	2	2	2	2	2	____
____ 3. Average cost to excavate spoil (¢/cu yd-dragline typical=20¢, truck & shovel typical=60¢)						
B. Stage in the Mining Sequence						
____ 1. Opening box cut	1	1	2	1	1	____
____ 2. Mine run	2	2	2	2	2	____
____ 3. Final box cut	1	1	3	3	1	____
C. Average Slope of 10 Random Points in the Area (Degrees)						
____ 1. 0 - 3.0	3	2	2	2	3	____
____ 2. 3.01- 5.7	2	3	2	3	2	____
____ 3. 5.71-11.5	0	2	3	2	1	____

Complete only one of the following units (D-I)

D. Dragline Mine-Opening Cut Spoil

____ 1. Vertical height of the spoil bank above ground level (feet)
____ 2. Initial average slope of the spoil bank (degrees)
____ 3. Total length of the spoil bank (yards)
____ 4. Average slope of the area perpendicular to the spoil bank axis (degrees)
____ 5. Average cost of grading spoil (¢/cu yd-typical=17¢)
6. Final slopes desired (in degrees) and the percent of the area to be covered by each slope. Ten (or fewer) slopes are allowed, and the total area covered must equal 100 percent. The maximum legal slope allowed is 19^{o} (33%). The minimum slope allowed is 11.5^{o} (20%), which is the lowest practical slope for economic reasons.

	Slope (degrees)	Percent of area
a.	________	________
b.	________	________
c.	________	________
d.	________	________
e.	________	________
f.	________	________
g.	________	________
h.	________	________
i.	________	________
j.	________	________
	TOTAL	100%

E. Dragline Mine-Mine Run Spoil

_____ 1. Average distance between spoil bank peaks (feet)
_____ 2. Initial average slope of the spoil banks (degrees)
_____ 3. Total area covered by spoil banks (acres)
_____ 4. Average slope of the area perpendicular to the spoil bank axis (degrees)
_____ 5. Average cost of grading spoil (¢/cu yd-typical=17¢)
6. Final slopes and percent of area for each slope desired (same format as D-6). The maximum slope allowed is equal to 19° The minimum slope can be no less than the original general slope of the area.

	Slope (degrees)	Percent of area
a.	____________	____________
b.	____________	____________
c.	____________	____________
d.	____________	____________
e.	____________	____________
f.	____________	____________
g.	____________	____________
h.	____________	____________
i.	____________	____________
j.	____________	____________
	TOTAL	100%

F. Dragline Mine-Final Cut Pit

_____ 1. Bottom width of the pit (feet)
_____ 2. Length of pit (yards)
_____ 3. Vertical height of highwall (feet)
_____ 4. Vertical height of spoil bank (feet)
_____ 5. Initial average slope of highwall (degrees)
_____ 6. Initial average slope of spoil bank (degrees)
_____ 7. Average cost of grading spoil (¢/cu yd-typical=17¢)
8. Final slopes and percent of area for each slope desired (same format as D-6). Requested slopes must be less than 19°. The minimum slope allowed is 11.5° (20%), the lowest practical slope for economic reasons.

	Slope (degrees)	Percent of area
a.	____________	____________
b.	____________	____________
c.	____________	____________
d.	____________	____________
e.	____________	____________
f.	____________	____________
g.	____________	____________
h.	____________	____________
i.	____________	____________
j.	____________	____________
	TOTAL	100%

G. Shovel and Truck-Opening Cut Spoil

____ 1. Average cost for spoils grading (¢/cu yd-typical=17¢)

Fill out the following for each highwall-bench pair (up to 10 pairs allowed) These data may be modified when interacting with the program.

1	2	3	4	5	6	7	8	9	10	
___	___	___	___	___	___	___	___	___	___	2. Vertical height of highwall (feet)
___	___	___	___	___	___	___	___	___	___	3. Average width of bench above highwall (feet - top bench can be no greater than 1/2 width of hilltop)
___	___	___	___	___	___	___	___	___	___	4. Average initial slope of highwall (degrees)
___	___	___	___	___	___	___	___	___	___	5. Length of bench along outside edge (feet)
___	___	___	___	___	___	___	___	___	___	6. Final slope desired on the highwall (degrees-1 slope per highwall)
___	___	___	___	___	___	___	___	___	___	7. Final terrace left on bench (feet)

8. What is the desired spoil pile configuration?
   ___ 1. semi-circular
   ___ 2. rectangular

H. Shovel and Truck-Mine Run Spoil

____ 1. Average cost for spoils grading (¢/cu yd-typical=17¢)
____ 2. Volume of rehandle necessary to maintain a minimum elevation, such as for surface water drainage (cu yd)
____ 3. Cost to rehandle spoil (¢/cu yd-typical=60¢)

Fill out the following for each highwall bench pair (up to 10 pairs allowed) These data may be modified when interacting with the program.

1	2	3	4	5	6	7	8	9	10	
___	___	___	___	___	___	___	___	___	___	4. Vertical height of highwall (feet-after any backfill)
___	___	___	___	___	___	___	___	___	___	5. Average width of bench above highwall (feet) (top bench can be no greater than 1/2 width of hilltop)
___	___	___	___	___	___	___	___	___	___	6. Average initial slope of highwall (degrees)
___	___	___	___	___	___	___	___	___	___	7. Length of bench along outside edge (feet)
___	___	___	___	___	___	___	___	___	___	8. Final slope desired on the highwall (degrees-1 slope per highwall)
___	___	___	___	___	___	___	___	___	___	9. Final terrace left on bench (feet)

10. What is the desired spoil pile configuration?
    ___ 1. semi-circular
    ___ 2. rectangular

I. Shovel and Truck-Final Cut Pit

___ 1. Average cost for spoils grading (¢/cu yd-typical=17¢)
___ 2. Volume of rehandle necessary to maintain a minimum elevation, such as for surface water drainage (cu yd)
___ 3. Cost to rehandle spoil (¢/cu yd-typical=60¢)

Fill out the following for each highwall-bench pair (up to 10 pairs allowed) These data may be modified when interacting with the program.

1	2	3	4	5	6	7	8	9	10		
__	__	__	__	__	__	__	__	__	__	4.	Vertical height of highwall (feet-after any backfill)
__	__	__	__	__	__	__	__	__	__	5.	Average width of bench above highwall (feet) (top bench can be no greater than 1/2 width of hilltop)
__	__	__	__	__	__	__	__	__	__	6.	Average initial slope of highwall (degrees)
__	__	__	__	__	__	__	__	__	__	7.	Length of bench along <u>outside</u> <u>edge</u> (feet)
__	__	__	__	__	__	__	__	__	__	8.	Final slope desired on the highwall (degrees-1 slope per highwall)
__	__	__	__	__	__	__	__	__	__	9.	Final terrace left on bench (feet)
										10.	What is the desired spoil pile configuration?
											___ 1. semi-circular
											___ 2. rectangular

Environmental Data Inputs

II. Climatology

	A. Average Total Annual Precipitation (in)	Cropl.	Native Veg.	Expectation of Success for each land use Wildl.	Water Recr.	High Use Struct.	Other
____	1. 5.0-10.0	1	1	1	1	1	____
____	2. 10.1-15.0	1	2	2	1	2	____
____	3. 15.1-20.0	2	3	2	2	2	____
____	4. 20.1-25.0	3	3	3	3	2	____

B. Average Annual Wind Velocity (mph)

____	1. 0 - 5.0	3	3	3	3	3	____
____	2. 5.1-10.0	2	2	2	2	2	____
____	3. 10.1-15.0	1	1	2	2	2	____
____	4. 15.1- +	1	1	1	1	1	____

III. Topsoil (Entire A horizon with greater than 0.1% organic matter)

Expectation of Success for each land use

	A. Thickness (inches)	Cropl.	Native Veg.	Wildl.	Water Recr.	High Use Struct.	Other
	1. 0 - 5.9 inches	1	1	1	1	1	
	2. 6.0-11.9 inches	2	2	2	2	2	
	3. 12.0-23.9 inches	2	3	3	2	2	
	4. 24.0- + inches	3	3	3	2	2	
	5. Cost to remove soil for storage (¢/cu yd-typical=90¢)						
	6. Cost to respread topsoil (¢/cu yd-typical=60¢)						
	7. Actual Thickness of Topsoil (in)						

	B. Percent organic matter	Cropl.	Native Veg.	Wildl.	Water Recr.	High Use Struct.	Other
	1. 0 - .9	1	1	1	1	2	
	2. 1.0-1.9	2	2	2	2	2	
	3. 2.0-+	3	3	3	3	2	

	C. Texture	Cropl.	Native Veg.	Wildl.	Water Recr.	High Use Struct.	Other
	1. Sandy	1	1	1	1	1	
	2. Sandy Loam	2	2	2	2	2	
	3. Loam	3	3	3	3	2	
	4. Silt Loam	2	2	2	2	2	
	5. Clay Loam	1	2	2	2	2	
	6. Clay	1	1	1	1	1	

D. Structure (percent of soil, by weight, combined into aggregates $\geq$ 1.0 mm in diameter-after redistribution)

	D. Structure	Cropl.	Native Veg.	Wildl.	Water Recr.	High Use Struct.	Other
	1. Weak - 0-25.0	1	1	1	1	2	
	2. Moderate 25.1-50.0	2	2	2	2	2	
	3. Strong - 50.1-+	3	3	3	2	2	

	E. Moist bulk density (after redistribution - g/cc)	Cropl.	Native Veg.	Wildl.	Water Recr.	High Use Struct.	Other
	1. 1.0 -1.50	2	2	2	2	2	
	2. 1.51-+	1	1	1	1	2	

	F. Salinity (EC value-mmhos/cm)	Cropl.	Native Veg.	Wildl.	Water Recr.	High Use Struct.	Other
	1. 0 - 2.0	3	3	3	3	3	
	2. 2.1- 4.0	2	2	2	2	2	
	3. 4.1- 8.0	1	2	2	2	2	
	4. 8.1-16.0	1	1	1	1	2	
	5. 16.1- +	0	1	1	1	1	

	G. Sodium Adsorption Ratio (meq/L)	Cropl.	Native Veg.	Wildl.	Water Recr.	High Use Struct.	Other
	1. 0 - 4.9	3	3	3	3	3	
	2. 5.0- 9.9	2	2	2	2	2	
	3. 10.0-14.9	1	1	1	1	2	
	4. 15.0- +	1	1	1	1	1	

	H. Available N(NH_4+NO_3) (ppm average entire depth-H_2SO_4 digestion method)	Cropl.	Native Veg.	Wildl.	Water Recr.	High Use Struct.	Other
				Expectation of Success for each land use			
____	1. 0 -2.9 "low"	1	1	1	1	2	____
____	2. 3.0-9.9 "medium"	2	2	2	2	2	____
____	3. 10.0 - + "high"	3	3	3	3	2	____

I. Available P (ppm average entire depth-$NaHCO_3$ extractable method)

____	1. 0 -50.0 "low"	1	1	1	1	2	____
____	2. 50.1-75.0 "medium"	2	2	2	2	2	____
____	3. 75.1-+ "high"	3	3	3	3	2	____

IV. Subsoil-Entire B Horizon of Significantly Weathered Material

				Expectation of Success for each land use			
		Cropl.	Native Veg.	Wildl.	Water Recr.	High Use Struct.	Other
A.	Thickness (in)						
____	1. 0 - 5.9	1	1	1	1	2	____
____	2. 6.0-11.9	2	2	2	2	2	____
____	3. 12.0-23.9	2	3	3	2	2	____
____	4. 24.0- +	3	3	3	2	2	____
B.	Texture						
____	1. Sandy	1	1	1	1	1	____
____	2. Sandy Loam	2	2	2	2	2	____
____	3. Loam	3	3	3	3	2	____
____	4. Silt Loam	2	2	2	2	2	____
____	5. Clay Loam	1	2	2	2	2	____
____	6. Clay	1	1	1	1	1	____
C.	Structure (percent of subsoil, by weight, combined into aggregates $\geq$ 1.0 mm in diameter-after redistribution)						
____	1. 0 -25.0 "weak"	1	1	1	1	2	____
____	2. 25.1-50.0 "moderate"	2	2	2	2	2	____
____	3. 50.1- + "strong"	3	3	3	2	2	____
D.	Moist bulk density (after redistribution-g/cc)						
____	1. 1.0 -1.5	2	2	2	2	2	____
____	2. 1.51-+	1	1	1	1	2	____
E.	Salinity (EC value-mmhos/cm)						
____	1. 0 - 2.0	3	3	3	3	3	____
____	2. 2.1- 4.0	2	2	2	2	2	____
____	3. 4.1- 8.0	1	2	2	2	2	____
____	4. 8.1-16.0	1	2	2	2	2	____
____	5. 16.1-+	1	1	1	1	1	____
F.	Sodium Adsorption Ratio (meq/L)						
____	1. 0 - 4.9	3	3	3	3	3	____
____	2. 5.0- 9.9	2	2	2	2	2	____
____	3. 10.0-14.9	1	2	2	2	2	____
____	4. 15.0-+	1	1	1	1	1	____
G.	Available N(NH_4+NO_3)(ppm average entire depth-H_2SO_4 digestion method)						
____	1. 0 -2.9 "low"	1	1	1	2	2	____
____	2. 3.0-9.9 "medium"	2	2	2	2	2	____
____	3. 10.0-+ "high"	3	3	3	2	2	____
H.	Available P(ppm average entire depth-$NaHCO_3$ extractable method)						
____	1. 0 -50.0 "low"	1	1	1	2	2	____
____	2. 50.1-75.0 "medium"	2	2	2	2	2	____
____	3. 75.1-+ "high"	3	3	3	2	2	____

V. Overburden-Bedrock lithological units 5 or more feet thick, above and between minable deposits. Classify only those units that will usually appear on the surface under the current mine plan. Start with the uppermost unit and proceed downward to the top of the lowest minable coal seam.

A. Number of rocks over 12 inches any dimension on surface to a depth of 12 inches, per acre, after blasting, mining and grading.

Unit No. (from top)											Expectation of Success for each land use					
1	2	3	4	5	6	7	8	9	10		Cropl.	Native Veg.	Wildl.	Water Recr.	High Use Struct.	Other
										1. 0- 10	3	2	2	2	3	
										2. 11- 100	2	3	3	2	2	
										3. 101-1000	1	2	2	2	2	
										4. 1001-+	1	1	1	1	1	

B. Thickness of each major lithologic unit (feet)

1	2	3	4	5	6	7	8	9	10

C. Texture of each unit after mining and weathering 1 year

1	2	3	4	5	6	7	8	9	10							
										1. Sandy	1	1	1	1	1	
										2. Sandy Loam	2	2	2	2	2	
										3. Loam	3	3	3	3	2	
										4. Silt Loam	2	2	2	2	2	
										5. Clay Loam	1	1	2	2	2	
										6. Clay	1	1	1	1	1	
										7. Consolidated Rock	1	1	2	2	3	

D. Moist bulk density (after redistribution-g/cc)

1	2	3	4	5	6	7	8	9	10							
										1. 1.0 -1.5	2	2	2	2	2	
										2. 1.51-+	1	1	1	1	2	

E. Salinity (EC value mmhos/cm)

1	2	3	4	5	6	7	8	9	10							
										1. 0 - 2.0	3	3	3	3	3	
										2. 2.1- 4.0	2	2	2	2	2	
										3. 4.1- 8.0	1	2	2	2	2	
										4. 8.1-16.0	1	1	2	2	2	
										5. 16.1-+	1	1	1	2	2	

F. Sodium Adsorption Ratio (meq/L)

1	2	3	4	5	6	7	8	9	10							
										1. 0 - 4.9	3	3	3	3	2	
										2. 5.0- 9.9	2	2	2	2	2	
										3. 10.0-14.9	1	2	2	2	2	
										4. 15.0-+	1	1	1	1	1	

G. Available N(NH_4+NO_3)(ppm average entire depth-H_2SO_4 digestion method)

Unit No. (from top) 1 2 3 4 5 6 7 8 9 10		Expectation of Success for each land use					
		Cropl.	Native Veg.	Wildl.	Water Recr.	High Use Struct.	Other
__ __ __ __ __ __ __ __ __ __	1. 0 -2.9 "low"	1	1	1	2	2	____
__ __ __ __ __ __ __ __ __ __	2. 3.0-9.9 "medium"	2	2	2	2	2	____
__ __ __ __ __ __ __ __ __ __	3. 10.0-+ "high"	3	3	3	2	2	____

H. Available P(ppm average entire depth-$NaHCO_3$ extractable method)

1 2 3 4 5 6 7 8 9 10							
__ __ __ __ __ __ __ __ __ __	1. 0 -50.0 "low"	1	1	1	2	2	____
__ __ __ __ __ __ __ __ __ __	2. 50.1-75.0 "medium"	2	2	2	2	2	____
__ __ __ __ __ __ __ __ __ __	3. 75.1-+ "high"	3	3	3	2	2	____

VI. Surface Water Hydrology

		Cropl.	Native Veg.	Wildl.	Water Recr.	High Use Struct.	Other
		Expectation of Success for each land use					
A.	Most reliable type of surface water present						
____	1. Perennial lake or pond	2	3	3	3	1	____
____	2. Perennial stream	3	3	3	3	1	____
____	3. Intermittent stream (flows ≥ 1 month)	2	2	2	2	2	____
____	4. Ephemeral stream (flows < 1 month)	1	1	1	1	3	____
B.	Amount of surplus surface water legally and physically available for appropriation and irrigation during April 1-Sept. 30 each year (acre feet of water per acre to be reclaimed)						
____	1. 0 -0	1	1	1	1	1	____
____	2. .11- .25	1	2	2	1	2	____
____	3. .26- .50	2	2	2	1	2	____
____	4. .51-1.0	3	3	2	2	2	____
____	5. 1.1 - +	3	3	3	3	1	____
C.	Index of dissection-Average feet of ephemeral channels per acre of original land surface						
____	1. 0 - 50.0	3	2	1	1	3	____
____	2. 50.1-100.0	2	3	2	3	2	____
____	3. 100.1- +	1	1	3	2	1	____
D.	Index of Meander-Average feet of perennial and/or intermittent streams per acre of original land surface						
____	1. 0 -25.0	1	1	1	1	3	____
____	2. 25.1-50.0	3	2	2	2	2	____
____	3. 50.1- +	2	3	3	3	1	____
E.	Salinity (EC-micro mhos/cm)						
____	1. 0- 250	3	3	3	3	3	____
____	2. 251- 750	2	2	2	2	2	____
____	3. 751-2250	1	2	2	2	2	____
____	4. 2251- +	1	1	1	1	1	____
F.	Sodium Adsorption Ratio (meq/L)						
____	1. 0 -10.0	3	3	3	3	3	____
____	2. 10.1-18.0	2	2	2	2	2	____
____	3. 18.1-26.0	1	2	2	1	2	____
____	4. 26.1- +	1	1	1	1	1	____

VII. Ground Water Hydrology

		Cropl.	Native Veg.	Wildl.	Water Recr.	High Use Struct.	Other
		Expectation of Success for each land use					
A.	Average depth to highest water table (nearest foot)						
_____	1. 0- 5	1	2	3	3	1	_____
_____	2. 6-15	3	3	2	2	1	_____
_____	3. 16-50	2	2	2	2	2	_____
_____	4. 51-+	1	1	1	1	3	_____
B.	Amount of Groundwater legally and physically available for appropriation and irrigation during April 1-Sept. 30 each year (acre feet of water per acre to be reclaimed)						
_____	1. 0 - .1	1	1	1	1	1	_____
_____	2. .11- .25	1	2	2	1	2	_____
_____	3. .26- .50	2	2	2	1	2	_____
_____	4. .51-1.0	3	2	2	2	2	_____
_____	5. 1.1 - +	3	2	2	3	2	_____
C.	Salinity (EC micro mhos/cm)						
_____	1. 0- 250	3	3	3	3	3	_____
_____	2. 251- 750	2	2	2	2	2	_____
_____	3. 751-2250	1	2	2	2	2	_____
_____	4. 2251- +	1	1	1	1	1	_____
D.	Sodium Adsorption Ratio (meq/liter)						
_____	1. 0 -10.0	3	3	3	3	3	_____
_____	2. 10.1-18.0	2	2	2	2	2	_____
_____	3. 18.1-26.0	1	2	2	1	2	_____
_____	4. 26.1- +	1	1	1	1	1	_____
E.	Minor Alluvial Valley Floor (as defined by law)						
_____	1. Present	3	3	3	3	0	_____
_____	2. Absent	2	2	2	2	2	_____

VIII. Vegetation

	Cropl.	Native Veg.	Wildl.	Water Recr.	High Use Struct.	Other
	Expectation of Success for each land use					
A. Current most important plant community type present						
_____ 1. Cropland (cereal grains and hayland)	3	2	2	1	2	_____
_____ 2. Improved range (interseeded with exotic species)	2	3	3	2	2	_____
_____ 3. Native rangeland	1	3	3	2	2	_____
_____ 4. Native riparian vegetation	2	3	3	3	1	_____
_____ 5. Threatened or endangered plant species present	0	4	1	1	0	_____
B. Current secondarily important plant community type present						
_____ 1. Cropland (cereal grains and hayland)	3	2	2	1	2	_____
_____ 2. Improved range (interseeded with exotic species)	2	3	3	2	2	_____
_____ 3. Native rangeland	1	3	3	2	2	_____
_____ 4. Native riparian vegetation	2	3	3	3	1	_____
_____ 5. No secondarily important plant community present	2	2	2	2	2	_____

IX. Animals

		Cropl.	Native Veg.	Expectation of Success for each land use: Wildl.	Water Recr.	High Use Struct.	Other
	A. Current most important abundant wildlife types present						
____	1. Harvestable big game mammals	1	3	3	2	1	____
____	2. Harvestable upland game birds and mammals	2	3	3	2	1	____
____	3. Harvestable wetlands birds and mammals	2	2	3	3	1	____
____	4. Presence of locally important and diverse non-game birds and/or mammals	2	3	3	2	1	____
____	5. Presence of threatened or endangered animal species	1	1	4	1	0	____
____	6. Abundant wildlife types are absent	3	2	1	2	2	____
	B. Current secondarily abundant wildlife types present						
____	1. Harvestable big game mammals	1	3	3	2	1	____
____	2. Harvestable upland game birds and mammals	2	3	3	2	1	____
____	3. Harvestable wetlands birds and mammals	2	2	3	3	1	____
____	4. Presence of locally important and diverse non-game birds and/or mammals	2	3	3	2	1	____
____	5. No secondarily abundant wildlife present	3	2	1	2	2	____
	C. Livestock grazing on adjoining lands						
____	1. Present	2	2	2	2	2	____
____	2. Absent	2	2	2	2	2	____

X. Socio-Economics

		Expectation of Success for each land use					
		Cropl.	Native Veg.	Wildl.	Water Recr.	High Use Struct.	Other
A.	Important Archaeologic, historic, cultural, or scientific sites to be preserved						
____	1. Present	1	2	2	1	3	____
____	2. Absent	2	2	2	2	2	____
B.	Primary usual land use during last 10 years						
____	1. "Prime" agricultural land	4	1	1	0	0	____
____	2. Cropland	3	2	2	2	1	____
____	3. Livestock grazing	2	3	2	2	1	____
____	4. Wildlife habitat	2	3	3	3	1	____
____	5. Water-oriented recr.	1	2	2	3	2	____
____	6. Homes, business, roads	2	1	1	1	3	____
C.	Secondary usual land use during last 10 years						
____	1. Cropland	3	2	2	2	1	____
____	2. Livestock grazing	2	3	2	2	1	____
____	3. Wildlife habitat	2	3	3	3	1	____
____	4. Water-based recreation	1	2	2	3	2	____
____	5. Homes, business, roads	2	1	1	1	3	____
____	6. No secondary use	2	2	2	2	2	____
D.	Future land use desire of post-mining surface owner						
____	1. Cropland	3	2	2	2	1	____
____	2. Livestock grazing	2	3	2	2	1	____
____	3. Wildlife habitat	2	3	3	3	1	____
____	4. Water-based recreation	1	2	2	3	2	____
____	5. Homes, business, roads	2	1	1	1	3	____
E.	Future land-use desires of local communities						
____	1. Cropland	3	2	2	2	1	____
____	2. Livestock Grazing	2	3	2	2	1	____
____	3. Wildlife habitat	2	3	3	3	1	____
____	4. Water-based recreation	1	2	2	3	2	____
____	5. Homes, business, roads	2	1	1	1	3	____
F.	Future land-use desires of government regulatory agencies						
____	1. Cropland	3	2	2	2	1	____
____	2. Livestock grazing	2	3	2	2	1	____
____	3. Wildlife habitat	2	3	3	3	1	____
____	4. Water-based Recreation	1	2	2	3	2	____
____	5. Homes, business, roads	2	1	1	1	3	____